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AGRICULTURAL NOTES

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## SOME PINEAPPLE PROBLEMS.

## 2nd ARTICLE. - SOIL MOISTURE.

By Henry C. Henricksen.

MAXIMUM WATER. - The pineapple plant does not thrive well in water-soaked soil but it can be grown in jars of water, as can most other plants, provided the water is well aerated. Also it grows well on a raised bank where the roots reach into water in the surrounding ditches provided the soil is muck. A clay soil under the same conditions is wholly unsuitable. In that respect, at least, the habit of the pineapple plant is similar to that of many other plants from which it differs otherwise. The coconut, for instance, which is water-loving, will not thrive on water-soaked soil in which the water becomes stagnant although it will thrive excellently on a river bank or a tidal flat where the water is more or less in motion. There are two reasons for that, one is the absence of oxygen in a soil that is saturated with stagnant water; the other is the presence of other gases formed from organic matter, which when formed in the absence of sufficient oxygen are usually poisonous to plant roots. The problem of maximum water is therefore principally one of minimum air and it will be discussed further under that heading.

MINIMUM WATER. - The amount of water needed by any plant, at any time during its growth, varies according to conditions, the discussion of which is not in place in this article. Part of the water taken up by a plant remains in the plant tissue, but the largest portion, by far, is transpired by the leaves. When transpiration is vigorous, as it is on a hot windy day, most plants will show some wilting for the reason that the roots cannot take up water as fast as the leaves give it off even though the moisture content of the soil is high. The pineapple plant, however, shows no wilting under such conditions. Even on a soil that is too dry for most other plants the pineapple plant shows no wilting for a long time. For that reason wilting cannot be used as a measure of water requirement of the pineapple plant. The writer has determined the water requirement by growing plants in twelve-quart pails filled with gravel the surface of which was sealed over with melted paraffin. The air was renewed around the roots by drawing air through tubes soldered into the bottom of the pail and with coils extending throughout the soil. The pails were weighed at intervals during a period of three months and the water supply was carefully adjusted. From the results of these tests it appears that the Red Spanish pineapple plant may be expected to produce maximum growth when the daily transpiration amounts to about 3% of the plant's weight: that is, a plant weighing 1 Kg. may be expected to transpire about 30 grams water in 24 hours. Individual plants differ considerably in



# AGRICULTURAL NOTES

REVISED BY

DEPARTMENT OF AGRICULTURE, UNITED STATES GOVERNMENT  
OFFICE OF THE CHIEF OF BUREAU OF PLANT INDUSTRY

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that respect and, of course, great differences are caused by environments. But in a soil that is capable of delivering 20 to 40 grams water in 24 hours to a well rooted plant six to eight months old that plant is not liable to suffer from drought provided other conditions are favorable. A grower may therefore ask "is my soil capable of supplying that amount during a dry season? and what are the weather probabilities for my locality?"

THE WEATHER. - This is always an uncertain factor, but in making estimates the records of twenty years or more are of considerable value. The records for Porto Rico show that prolonged periods dry enough to cause much injury to pineapple plants are not frequent in districts where pineapples are now grown. What may be expected in dry localities is well illustrated by the Palmarejo fields. There the average annual rainfall is but 34 to 35 inches with but a fraction over one inch per month during the months of December, January and February. It is true that during those three months the plants do not usually make much growth in that locality, but when they have been set early and have become well rooted and well developed before the beginning of the dry season they do not suffer much from drought. This is further confirmed by experience in the Bayamón section where the crop is usually best when the winter months are driest.

SOIL MOISTURE IN RELATION TO THE PINEAPPLE PLANT. - How much water a plant can take up from a certain soil with a certain moisture content is governed, among other things, by its root system. The roots of the pineapple plants may be confined to the upper few inches of soil or some of them may go down two feet or more. Also in some cases the root system may be well developed whereas in other cases there seems to be scarcely enough roots to support the plant. An extreme example of the latter case is where the roots are eaten off by grubs. Such plants, having no roots, may live for a long time, especially if the soil is very moist, but they can take up no food and consequently the growth ceases, the chlorophyll formation stops and the leaves become red in color. That condition is, therefore, no indication of soil moisture. If, on the other hand, the root system is well developed but the soil becomes dry then the plants do not become intensely red in color. The first signs of disturbance is a gradual drying of the outer leaves and that is a sign of dry soil. It is not a proof, however, for such drying of the leaves may take place even though the soil is fairly moist. It may be caused by insufficient aeration of the soil or by a number of factors that tend to prevent the roots from functioning properly. It is, therefore, more or less difficult to determine how much water a certain soil must contain in order to supply 20 to 40 grams water daily to a medium size pineapple plant, but wherever the conditions are such that the minimum water content becomes an important question much valuable information may be obtained by the use of soil points.







THE SOIL POINT METHOD. - With this method the soil moisture is determined by the increase in weight of some absorbent material when buried in the soil for a certain length of time. The material used in this investigation consisted of cylinders made of brick clay and baked medium hard. The cylinders were made in a mold of brass tubing 1-5/16 inch diameter and 6 inches long. After baking they measured 1 inch in diameter and slightly more than 5 inches long. The ends were painted with shellac, making the absorbing surface of each tube 16 square inches. Also when molding the cylinders a cavity was made in one end. After baking, this cavity was filled with a wooden plug and a small cup hook inserted. The average weight of the cylinders was 138 grams when dry and 164 grams when saturated. That is each cylinder was capable of holding an amount of water equal to about 19% of its weight.

The soil moisture was measured in the following manner: The dry cylinders were weighed after which they were buried about six inches deep in the soil, several cylinders in one place about a foot apart. After 24 hours the cylinders were taken up, brushed off and again weighed. The gain in weight by all the cylinders divided by the number used represented the average amount of moisture absorbed by one cylinder from that soil. The cylinders were hung up to dry by means of the hooks attached, and again used when thought desirable to record changes in soil moisture content.

The amount of moisture that a cylinder may absorb from a soil during a certain time depends upon the moisture content, but it varies with different soils. Whether or not the capacity of the pineapple plant for absorbing water differs in the same ratio has<sup>not</sup> been finally determined, but the writer has found that a soil which will deliver an average of five grams water each 24 hours to each cylinder used will also supply 20 to 40 grams to a well rooted pineapple plant in the same length of time. With that knowledge, a planter may make a test from time to time during a dry season and as long as his soil points, continue to absorb five grams of moisture each 24 hours he may conclude that his pineapple plants are not suffering from drought.



